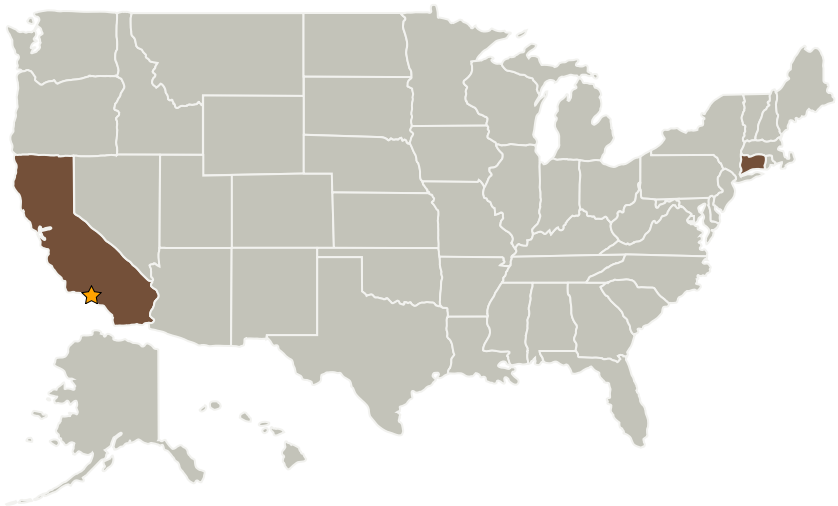
# Apodized Occulting and Pupil Masks for Imaging Coronagraphs, Phase I

Completed Technology Project (2007 - 2007)

## Project Introduction

The technical challenge of imaging planets in other star systems is resolving these dim objects in the close vicinity of a bright star. This challenge requires the suppression of direct and scattered light from the star without attenuating or distorting the planet's image. We will develop and demonstrate high performance apodized occulting and pupil masks using a metal/metal oxide film blended to have an effective refractive index of 1.0. These masks provide for high optical density (OD) and high spatial thickness gradients with out introducing variations in phase or optical thickness. These films can be used for apodized occulting masks as well as pupil masks and baffles. An imaging coronagraph is an astronomical instrument used to study dim objects such as brown dwarfs or planets that are in the vicinity of very bright objects such a star. A critical component of the coronagraph is an apodized occulting mask. This mask is a high quality optical component which has a point of high optical density that can be used to block the light from the star without distorting or occulting the image of objects in close proximity to the star. The occulting spot must have sufficient optical density to reduce the intensity of the bright star to at least that of that of the dim object. the image, the optical density must be radially apodized from high OD at the center to very low OD with in 1 mm or so and in a controlled manner. Furthermore, the occulting spot should not induce a phase change or optical path difference for rays passing through different parts of the occulting spot. The proposed solution is to deposit films with a metal/metal oxide blend such that the effective index of the blended film is 1.0 and matches the refractive index of the entrance media. By matching the refractive index of the film and air/vacuum, the optical path of rays passing through the variable thickness of the film are the same length.

## Primary U.S. Work Locations and Key Partners

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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Jet Propulsion Laboratory (JPL)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

**Small Business Innovation Research/Small Business Tech Transfer**

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★Jet Propulsion Laboratory(JPL) | Lead Organization | NASA Center | Pasadena, California |
| Rugate Technologies, Inc. | Supporting Organization | Industry | Oxford, Connecticut |

| Primary U.S. Work Locations | |
|---|---|
| California | Connecticut |

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  - TX05.1 Optical Communications
    - TX05.1.4 Pointing, Acquisition and Tracking (PAT)